# THE MOSSES OF MINERS COVE, GREAT BARRIER ISLAND, NORTHERN NEW ZEALAND

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*Abstract.* Eighty-four species of mosses from 32 families are recorded from the Miners Cove area of northern Great Barrier Island, Hauraki Gulf, New Zealand. *Fissidens hyophilus* Mitt., a moss known from Queensland, Australia, is recorded new to New Zealand. Two other species with tropical affinities, which have seldom been recorded from New Zealand, were found in the area: *Syrrhopodon armatus* Mitt. of the Calymperaceae and *Thuidium cymbifolium* (Dozy & Molk.) Dozy & Molk. of the Thuidiaceae. The modifying effects of goats and pigs on the moss communities are noted.

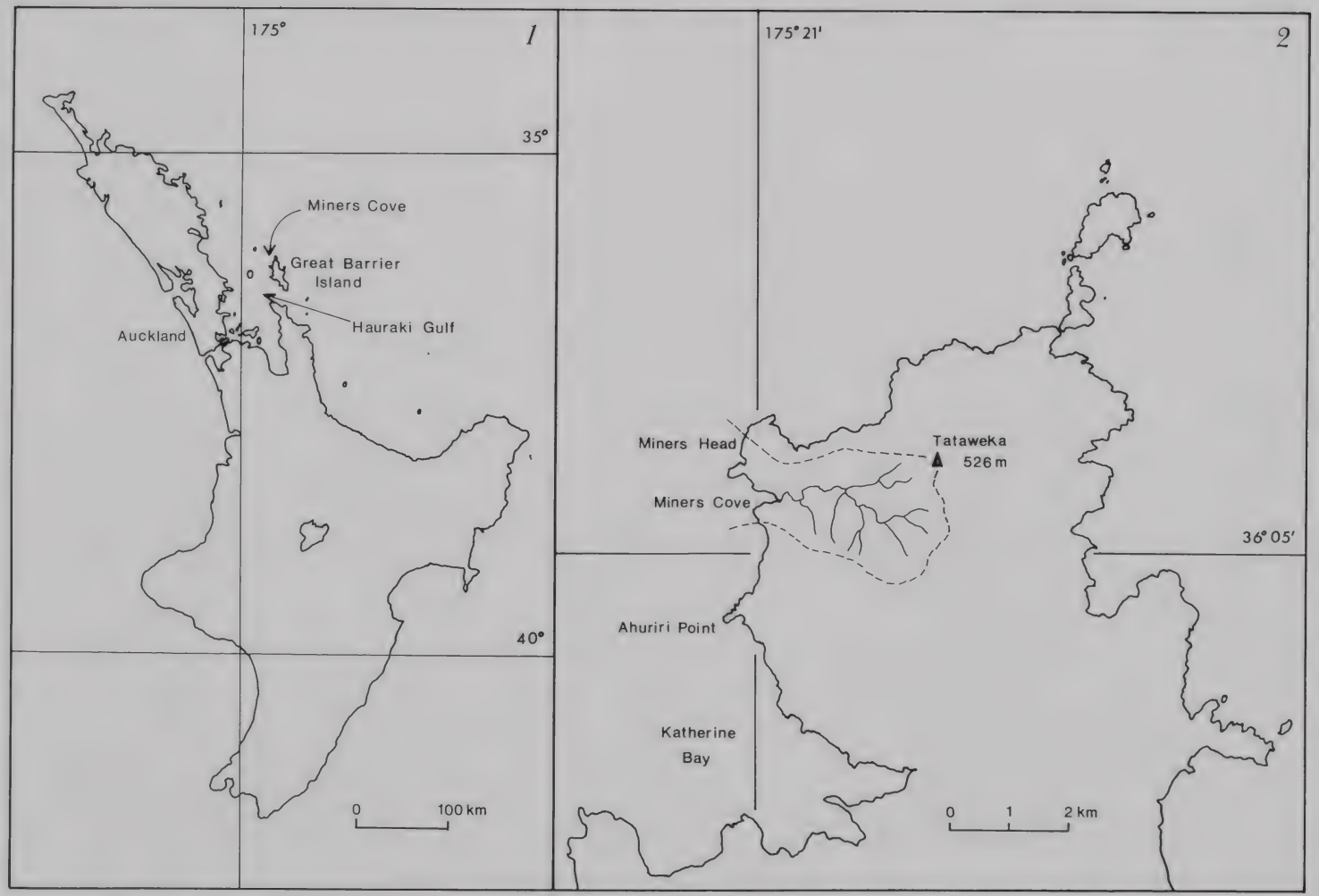
Miners Cove, in the far north-west of Great Barrier Island, lies at latitude 36° 05'S longitude 170° 21'E at the outer edge of the Hauraki Gulf, northern New Zealand (Figs. 1,2). This paper is based on observations and collections made during a visit of the Offshore Islands Research Group to Miners Cove from 30 December 1988 to 7 January 1989. A survey for mosses was carried out in the area from the coast to the peak of Tataweka, at 526 m the highest point in northern Great Barrier, with the main emphasis being in the lower reaches of the Miners Cove catchment. Although seven days were spent in the field, field work was hampered by bad weather.

*Vascular plant vegetation*

Near the coast, grassland and tea-tree scrub cover the slopes and valley floor, but most of the catchment supports a modified coastal forest, dominated by puriri (*Vitex lucens* Kirk), kohekohe (*Dysoxylum spectabile* (Forst. f.) Hook. f.) and taraire (*Beilschmiedia tarairi* (A. Cunn.) Kirk). Extensive damage by goats, culled two years prior to the visit, and by pigs, has resulted in a very open understorey to the forest. A detailed account of the vascular flora of the area is in preparation by E.K. Cameron and A.E. Wright (pers. comm. June 1990).

*Previous bryological studies*

Bryophytes have been collected sporadically on Great Barrier I for many years, and numerous specimens are held in herbaria, both in New Zealand and overseas. These are the basis of a number of published records of mosses from the island, as in the monographs of the family Hypnodendraceae (Touw 1971) and the genus *Macromitrium* (Vitt 1983), and in more general accounts of the northern offshore




Figs. 1,2. Location of study area. 1. Location of Miners Cove, Great Barrier I, and the North Island, New Zealand. 2. Northern tip of Great Barrier I showing study area (circumscribed by dotted line).

islands (Beever 1986a), and of the New Zealand moss flora as a whole (Sainsbury 1955). The type specimen of *Stereodon maculosus* Dix., now regarded by some as a form of *Camptochaete pulvinata* (Hook. f. & Wils.) Jaeg., was collected by Hutton and Kirk last century, probably on Great Barrier I, although the specimen is merely labelled 'N.Z.' (Sainsbury 1955). There are however to my knowledge no published accounts of the moss flora of the island as a whole, nor of any of its regions.

*Major features of the moss communities*

In areas of grassland near the coast both *Hypnum cupressiforme* and *Thuidium furfurosum* were common among the herbaceous plants, with *Bryum campylothecium* and *Macromitrium brevicaule* occurring on exposed rock.

The main stream draining the valley is sufficiently broad in its lower reaches to allow a considerable canopy gap over the stream, and thus light-requiring mosses such as *Tridontium tasmanicum*, *Fissidens vittatus*, and *Ptychomitrium australe* were found on stream-side rocks, with *Brachythecium plumosum* on large boulders in the stream. *Fissidens asplenioides* and *Hypopterygium rotulatum* were common on soil on the stream banks, as were *Thuidium furfurosum* and *Camptochaete pulvinata* on silt-covered rock at the stream margins. *Thuidium cymbifolium* was recorded at two sites beside the main stream of the catchment, one on silt over rock at the stream margin, and the other on sloping soil above the stream. Luxurious growth of *Achrophyllum dentatum* occurred in seepages along stream banks, with *Homalia falcifolia* forming extensive sheets in drier sites. *Leptostomum macrocarpum* was seen occasionally as an epiphyte, but was more common on rock outcrops above the stream, in areas of high light.

Few mosses were found on the forest floor. *Fissidens oblongifolius* var. *capitatus* and *Echinodium umbrosum* occurred on sloping soil, with *Distichophyllum crispulum* in the wetter sites. Epiphytes were scarce in the forest, the most common being *Macromitrium gracile*. Other epiphytes recorded several times included *M. ligulare*, *Thuidium sparsum*, *Orthorrhynchium elegans*, *Haplohymenium pseudotriste*, and *Dicnemon calycinum*, with *Ctenidium pubescens* occasional on tree bases, as well as on soil. *Calomnion complanatum* was very common on trunks of the tree-fern *Cyathea dealbata*, while *Syrrhopodon armatus* was occasional in the same habitat.

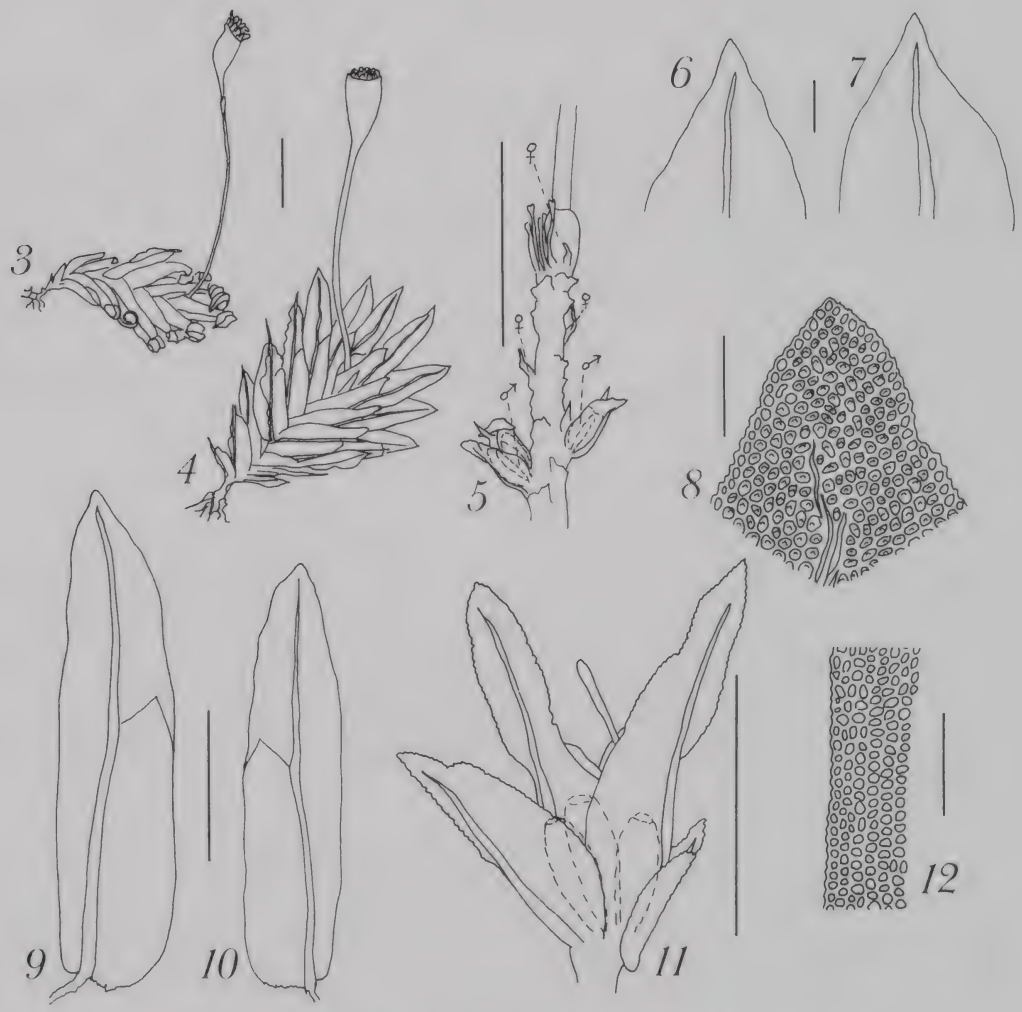
The open understorey, due to the activities of goats and pigs, has no doubt contributed to the paucity of ground-dwelling and epiphytic mosses in the forest. Habitats associated with the streams have probably also been modified as a result of animal activity, due to increased water run-off and decreased soil stability. Twice during the study period the stream banks were scoured by silt-laden floodwaters, when the main stream rose approximately 1 m above its normal level.

*Floristics*

In all, 84 species from 32 families were recorded. Most are widespread species, common in open coastal communities or forest throughout New Zealand. Some, such as *Macromitrium brevicaule*, *Haplohymenium pseudotriste* and *Fissidens*

*oblongifolius* var. *capitatus*, have a northern distribution within the country. Of particular interest is the recording of three mosses of tropical affinity which have only recently been recognised in New Zealand, namely *Fissidens hyophilus*, *Syrrhopodon armatus*, and *Thuidium cymbifolium*.

*Fissidens hyophilus* Mitt. (Figs. 3-12), a species previously known from Queensland, Australia, is here recorded new to New Zealand. It has been confused with the morphologically similar *F. oblongifolius* Hook. f. & Wils. var. *capitatus* Wils.




Figs. 3-12. *Fissidens hyophilus* Mitt. 3. Plant, dry. 4. Plant, moist. 5. Upper part of fertile stem with leaves removed to show base of seta, archegonia, and perigonial buds with antheridia. 6,7. Leaf apices. 8. Cells of leaf apex. 9,10. Leaves. 11. Perigonial bud with antheridia. 12. Cells at margin of vaginant lamina. Figs. 3,4,6-10,12. Poor Knights Is (AK 195501). Figs. 5,11. Poor Knights Is (AK 195500). Scale Bars. Figs. 3,4,5. 1mm. Figs. 6,7. 0.1mm. Figs. 8,12. 50$\mu$m. Figs. 9,10,11. 0.5 mm.

*in* Hook. f., but is distinctive in the field in having the tips of the leaves rolled up away from the substrate when the plants are dry (Fig. 3). In addition the capsules are narrow and more or less straight (Figs. 3,4), rather than broad and curved as they are in *F. oblongifolius* var. *capitatus*. Both species are autoicous, with male gametangia found in axillary buds on the stem (Fig. 5), but the leaves of these buds are less well developed in *F. hyophilus* (Figs. 5,11). Figure 13 shows the known distribution of *F. hyophilus* in New Zealand, and is based on the author's field work and also on specimens found when the holdings of *F. oblongifolius* in the herbaria of the Auckland Institute and Museum (AK), the Botany Department, University of Auckland (AKU), the Botany Institute, DSIR Land Resources (CHR), and the National Museum of New Zealand (WELT) were critically examined. The New Zealand distribution reflects the tropical affinities of the moss, with all records coming from low elevation sites on the North Auckland peninsula and its offshore islands, plus one specimen from the Kermadec Islands. Of the 11 specimens for which substrate data were available, 6 specimens were from rock, most commonly from the vertical side or sloping underside of outcrops or large boulders, with rock types including greywacke and rhyolitic breccia; 4 were epiphytic, on nikau palm (*Rhopalostylis sapida* Wendl. & Drude), tawapou (*Planchonella costata* (Endl.) Pierre *ex* H.J. Lam) or *Coprosma areolata* Cheesem.; and one was from exposed roots. All 11 were from shaded sites. Several of these collections have already been cited in publications, namely J.E. Beever 31-77 and 31-95 from Whangaruru North Head (Beever 1985); J.E. Beever 28-85 (misprinted as 29-85), 29-86 and 29-89 from the Poor Knights Is (Beever 1986b), all as *Fissidens oblongifolius*; and J.E. Beever 57-69 from Hukatere Scenic Reserve (Beever 1990), as *Fissidens* sp. (epiphytic).

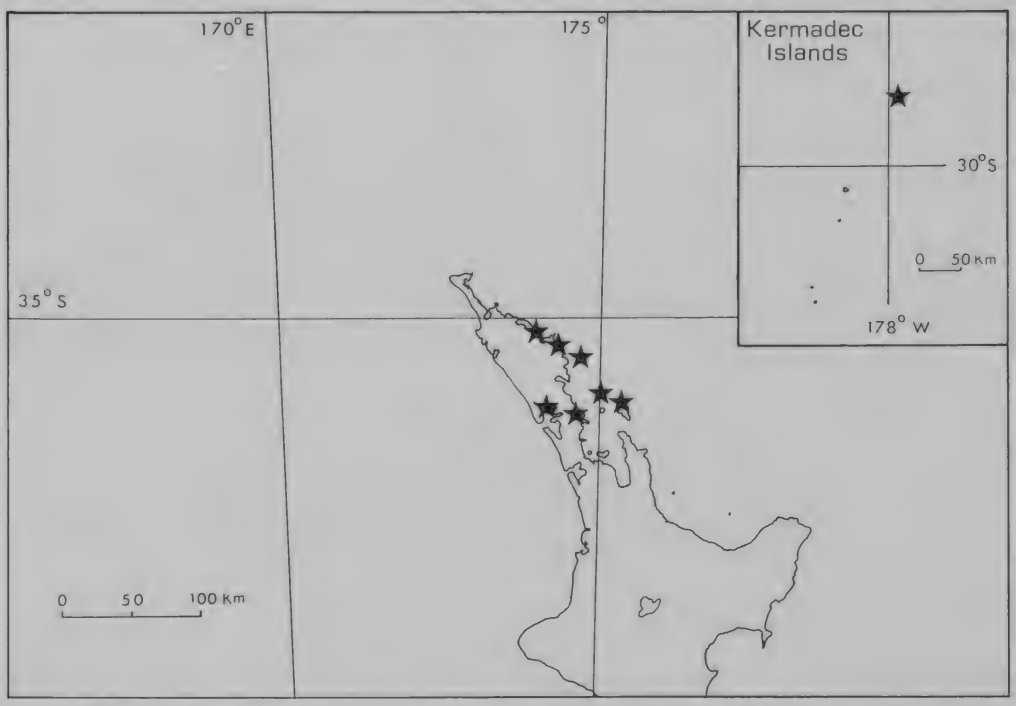



Fig. 13. Known distribution of *Fissidens hyophilus* Mitt. in New Zealand.

*Syrrhopodon armatus* Mitt., a widespread tropical species, was first recorded in New Zealand by Reese & Bartlett (1982), as *S. fimbriatulus* C. Muell., at Hot Water Beach on the Coromandel Peninsula. It has since been recorded in two other northern coastal sites, at Whangaruru North Head (Beever 1985) and on the Poor Knights Is (Beever 1986b). Although inconspicuous in the field, this moss is distinctive under the microscope, with large spines on the nerve and lower leaf margins, quite unlike any other New Zealand moss. On Great Barrier it was found on trunks of *Cyathea dealbata* in rather open coastal forest, along stream banks in the middle reaches of the Miners Cove catchment.

*Thuidium cymbifolium* is a tropical Indopacific species. New Zealand material has recently been recognised by Touw & Falter-van den Haak (1989), who located 5 New Zealand specimens, three of them with detailed locality data, in the course of examining herbarium material of *Thuidium* for a revision of the Australasian members of that genus. The species has in the past been confused with *Thuidium laeviusculum* (Mitt.) Jaeg., which it resembles in its regular and compact bipinnate to tripinnate branching pattern, and in the robust primary stems densely clothed with paraphyllia. At the microscopic level *T. cymbifolium* is easily distinguished from *T. laeviusculum* as it has a single papilla on each leaf lamina cell, while *T. laeviusculum* has multipapillose lamina cells. In addition, on the leaves of the ultimate branches, the cells on the back of the nerve towards the nerve apex are smooth, or bear large single teeth, while those of *T. laeviusculum* are multipapillose. *T. cymbifolium* can be distinguished from the other two species of *Thuidium* recorded at Miners Cove, namely *T. sparsum* and *T. furfurosum*, by its regular, compact, and more highly divided, branching pattern. Critical examination of holdings of *T. laeviusculum* in AK and AKU (not examined by Touw & Falter-van den Haak), and further field work, have brought to light more material of *T. cymbifolium*, and some 8 localities are now known for this moss in New Zealand, all of them north of latitude 36° 35'S.

The 'maculosa' form of *Camptochaete pulvinata*, for which Great Barrier I is believed to be the type locality, was common in the Miners Cove area. It occurred both on rock, especially on large boulders in small tributary streams, and on tree bases and large exposed roots, e.g. of puriri. Both compact dendroid forms, and long, pinnately branched runners were observed. Sometimes regarded as a separate species from *C. pulvinata*, there has been considerable uncertainty about the correct taxonomic position of this moss, and collections were made of fruiting material for future studies.

## SPECIES LIST

This list includes all species of mosses that were found in the Miners Cove area, and the accession numbers of voucher specimens lodged in Auckland Museum.

Bartramiaceae
*Philonotis tenuis* (Tayl.) Reichdt. AK 181014

Brachytheciaceae
*Brachythecium plumosum* (Hedw.) B.S.G. AK 189059
*Rhynchostegium tenuifolium* (Hedw.) Reichdt. AK 189049

Bryaceae
- *Bryum billardierei* Schwaegr. var. *platyloma* Mohamed — AK 189057
- *Bryum campylothecium* Tayl. — AK 189052
- *Bryum dichotomum* Hedw. — AK 189055
- *Bryum erythrocarpoides* C. Muell. & Hampe — AK 189087
- *Leptostomum macrocarpum* (Hedw.) Pyl. — AK 189098
- *Pohlia wahlenbergii* (Web. & Mohr) Andr. — AK 189042

Calomniaceae
- *Calomnion complanatum* (Hook. f. & Wils.) Lindb. — AK 189109

Calymperaceae
- *Syrrhopodon armatus* Mitt. — AK 189068

Cyrtopodaceae
- *Cyrtopus setosus* (Hedw.) Hook. f. — AK 189099

Dicnemonaceae
- *Dicnemon calycinum* (Hook.) Schwaegr. — AK 189093

Dicranaceae
- *Campylopus clavatus* (R. Br.) Wils. — AK 189037
- *Campylopus introflexus* (Hedw.) Brid. — AK 189054
- *Campylopus pyriformis* (Schultz) Brid. — AK 189056
- *Dicranella clathrata* (Hook. f. & Wils.) Jaeg. — AK 189045
- *Dicranoloma fasciatum* (Hedw.) Par. — AK 189101
- *Dicranoloma menziesii* (Hook. f. & Wils.) Par. — AK 189108, AK 181019
- *Holomitrium perichaetiale* (Hook.) Brid. — AK 181018, AK 181017
- *Leucobryum candidum* (P. Beauv.) Wils. — AK 189092

Ditrichaceae
- *Ditrichum difficile* (Duby) Fleisch. — AK 189090

Enchinodiaceae
- *Echinodium umbrosum* (Mitt.) Jaeg. — AK 189102

Fissidentaceae
- *Fissidens asplenioides* Hedw. — AK 189040
- *Fissidens humilis* Dix. & Watts var. *angustifolius* Dix. — AK 189060
- *Fissidens hyophilus* Mitt. — AK 194663
- *Fissidens leptocladus* C. Muell. & Rodw. — AK 189032
- *Fissidens oblongifolius* Hook. f. & Wils. var. *capitatus* Wils. *in* Hook. f. — AK 194795
- *Fissidens pungens* C. Muell. & Hampe — AK 189076
- *Fissidens rigidulus* Hook. f. & Wils. — AK 189088
- *Fissidens tenellus* Hook. f. & Wils. — AK 189083
- *Fissidens vittatus* Hook. f. & Wils. — AK 189085

Funariaceae
- *Funaria hygrometrica* Hedw. — AK 189086

Grimmiaceae
- *Schistidium apocarpum* (Hedw.) B.S.G. — AK 189064

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| Hookeriaceae | |
| *Achrophyllum dentatum* (Hook. f. & Wils.) Vitt & Crosby | AK 189043 |
| *Achrophyllum quadrifarium* (Sm.) Vitt & Crosby | AK 189077 |
| *Distichophyllum crispulum* (Hook. f. & Wils.) Mitt. | AK 189074 |
| Hypnaceae | |
| *Ctenidium pubescens* (Hook. f. & Wils.) Broth. | AK 189050 |
| *Hypnum chrysogaster* C. Muell. | AK 189048 |
| *Hypnum cupressiforme* Hedw. | AK 189034 |
| Hypnodendraceae | |
| *Hypnodendron arcuatum* (Hedw.) Lindb. | AK 189094 |
| Hypopterygiaceae | |
| *Cyathophorum bulbosum* (Hedw.) C. Muell. | AK 189105 |
| *Hypopterygium commutatum* C. Muell. | AK 189078 |
| *Hypopterygium filiculaeforme* (Hedw.) Brid. | AK 189079 |
| *Hypopterygium rotulatum* (Hedw.) Brid. | AK 189041 |
| *Lopidium concinnum* (Hook.) Hook. f. & Wils. | AK 189080 |
| Lembophyllaceae | |
| *Camptochaete arbuscula* (Sm.) Reichdt. | AK 189103 |
| *Camptochaete gracilis* (Hook. f. & Wils.) Par. | AK 189097 |
| *Camptochaete pulvinata* (Hook. f. & Wils.) Jaeg. | AK 189106 |
| *Camptochaete ramulosa* (Mitt.) Jaeg. | AK 189075 |
| Meteoriaceae | |
| *Papillaria crocea* (Hampe) Jaeg. | AK 189089 |
| *Weymouthia cochlearifolia* (Schwaegr.) Dix. | AK 181021 |
| *Weymouthia mollis* (Hedw.) Broth. | AK 181023, AK 181024 |
| Neckeraceae | |
| *Homalia falcifolia* (Hook. f. & Wils.) Hook. f. & Wils. | AK 189046 |
| *Homalia punctata* (Hook. f. & Wils.) Wijk & Marg. | AK 189073 |
| *Porotrichum oblongifolium* (Hook. f. & Wils.) Broth. | AK 189067 |
| *Thamnobryum pandum* (Hook. f. & Wils.) Stone & Scott | AK 189044 |
| Orthotrichaceae | |
| *Macromitrium brevicaule* (Besch.) Broth. | AK 189053 |
| *Macromitrium gracile* (Hook.) Schwaegr. | AK 181020 |
| *Macromitrium ligulare* Mitt. | AK 189081 |
| *Macromitrium longipes* (Hook.) Schwaegr. | AK 181016 |
| *Zygodon intermedius* B.S.G. | AK 189082 |
| Phyllogoniaceae | |
| *Orthorrhynchium elegans* (Hook. f. & Wils.) Reichdt. | AK 189058 |
| Plagiotheciaceae | |
| *Catagonium nitens* (Brid.) Card. | AK 189047 |

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| Polytrichaceae | |
| *Pogonatum subulatum* (Brid.) Brid. | AK 189091 |
| *Polytrichadelphus magellanicus* (Hedw.) Mitt. | AK 189095 |
| Pottiaceae | |
| *Hymenostomum patulum* (Knight) Dix. | AK 188972 |
| *Tortula pagorum* (Milde) De Not. | AK 189033 |
| ?*Trichostomum brachydontium* Bruch* | AK 189038, AK 189051, AK 189110 |
| *Tridontium tasmanicum* Hook. f. | AK 189063 |
| *Triquetrella papillata* (Hook. f. & Wils.) Broth. | AK 189036 |
| Pterobryaceae | |
| *Trachyloma diversinerve* Hampe | AK 189100 |
| Ptychomitriaceae | |
| *Ptychomitrium australe* (Hampe) Jaeg. | AK 181013 |
| Ptychomniaceae | |
| *Cladomnion ericoides* (Hook.) Hook. f. & Wils. | AK 181022 |
| *Ptychomnion aciculare* (Brid.) Mitt. | AK 181015 |
| Racopilaceae | |
| *Racopilum convolutaceum* (C. Muell.) Reichdt. | AK 181026 |
| *Racopilum robustum* Hook. f. & Wils. | AK 189065 |
| Rhizogoniaceae | |
| *Hymenodon pilifer* Hook. f. & Wils. | AK 189066 |
| *Pyrrhobryum bifarium* (Hook.) Manuel | AK 189084 |
| Sematophyllaceae | |
| *Sematophyllum amoenum* (Hedw.) Mitt. | AK 189039 |
| *Sematophyllum contiguum* (Mitt.) Mitt. | AK 189062 |
| Thuidiaceae | |
| *Haplohymenium pseudotriste* (C. Muell.) Broth. | AK 189107 |
| *Thuidium cymbifolium* (Dozy & Molk.) Dozy & Molk. | AK 189061, AK 189096 |
| *Thuidium furfurosum* (Hook. f. & Wils.) Reichdt. | AK 189035 |
| *Thuidium sparsum* (Hook.f. & Wils.) Jaeg. | AK 189031, AK 189104 |

* While *Trichostomum brachydontium* Bruch was not positively recorded at Miners Cove, 3 specimens have been tentatively identified as such. The plants were collected from soil and weathered rock in lightly shaded sites, and have plane leaf margins and more than 6 cells in the axillary hairs, but lack mature capsules.

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